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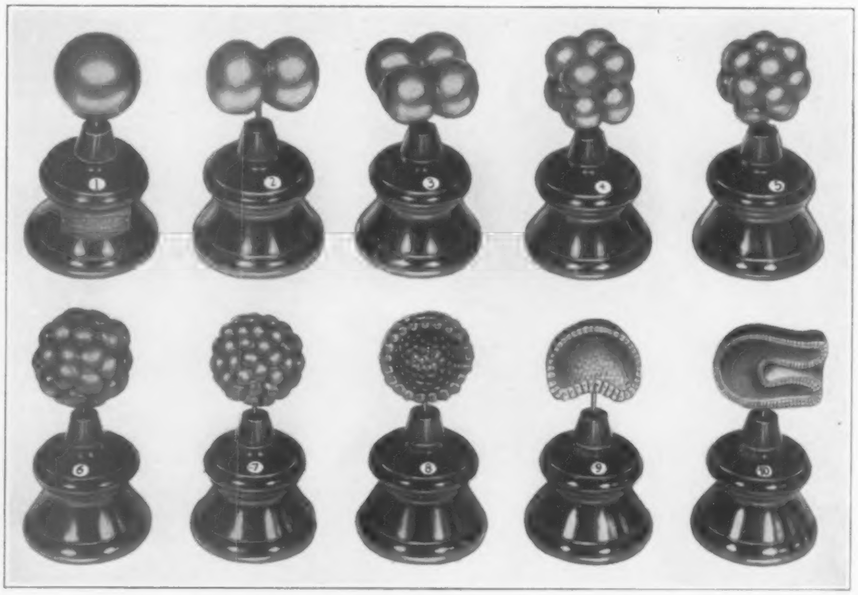

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS ☐ NEW
MR. P. K. HOUDEK, *Sec'y-Treas.*, Robinson, Illinois ☐ RENEWAL

I hereby apply for membership in The National Association of Biology Teachers and enclose $1.00 as my annual membership dues 80c of which is for a year's subscription to The American Biology Teacher. (Subscription may not be had separately)

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THE AMERICAN BIOLOGY TEACHER

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The American Biology Teacher

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The Problem Approach to Biology[1]

ELLA THEA SMITH
Salem High School, Salem, Ohio

It seems strange that any human being should dislike the process of being educated, since man is the only animal capable of extensive education. Because we can be trained in the accumulated knowledge of hundreds of past generations, we are able to benefit from the past experiences of our species. Otherwise each new generation would be forced to start from scratch, as any other animal must do. Even if a dog were able to invent and use a bow and arrow to get his prey, he could not teach his offspring to make or use his invention. Consequently, the invention would perish with him. Not so with man, for he can teach the next generation. Otherwise, all of us would be picking berries off bushes and struggling bare-handed to get food and shelter, unless an occasional one invented some tool for himself.

Man's capacity for being educated gives him his chief advantage over other animals, yet each new generation rebels more or less against its great opportunity. The dislike for school is so widespread that it has become proverbial. Why?

Teachers of biology are particularly fortunate in that it is probably easier to interest students in their course than in most others. Perhaps this is because biology touches the familiar, everyday experiences of students to a much greater extent than most other subjects. Even so, the problem of motivation confronts every biology teacher every day. There is always the challenge, how can we overcome the indifference, the distaste of our students for school?

If we could only find out why students dislike school, perhaps we might discover a clue as to how to overcome their indifference. One way to find out is to ask the students themselves. They have many answers, but one general conclusion may be drawn from the replies of several hundreds of students over a

[1] Given before the Kansas Association of Biology Teachers, Wichita, Kansas, November 1, 1940.

period of many years. Students almost invariably feel that they are on the defensive in the schoolroom and naturally they do not like it. No student ever says in so many words that he feels he is on the defensive. His words are more apt to be that he thinks the teacher is always trying to "catch him up," or "put him on the spot," or at best "to see if he has learned his assigned lesson."

Of course the students are mistaken. The last thing in the world teachers want to do is to make students feel that they are on the defensive in the classroom. Teachers expend their energies every day to help students acquire skills, knowledge, appreciations, and experiences that will help them live happier, healthier, and more useful lives. Nevertheless, the students get the feeling that teachers are more against them than for them. Can it be that something in the traditional teaching procedure calls forth this attitude in the students?

A sentence in the autobiography of a well-known author and newspaperman seems pertinent to the question. This man had disliked school, college and university, and he knew that many, perhaps most, of his classmates had shared his dislike. In his more mature years, he often puzzled over this general distaste for school. Finally he said he thought he had discovered the reason, which he stated as follows: "The thing that is wrong with our schools is that the teachers ask the questions instead of the students." That is a startling statement, worth some thoughtful attention.

Teachers will ask at once why the teacher should not ask the questions. The author of the autobiography just quoted would probably answer somewhat as follows: "Teachers ask questions to see if students have *learned* the answers, but most persons ask questions because they *want to know* the answers. A six-year-old can ask enough questions in a day to drive his elders nearly to distraction. What becomes of this natural, eager curiosity of the child by the time he reaches high school? Does it die out? Does he lose his desire to know how, when, or why? Or, does he learn slowly, but surely, that school is not the place where persons ask questions because they *want to know* the answers? Does he not learn that school is the place where persons ask questions to see if someone has *learned* the answers?"

This analysis by a very intelligent adult may help teachers to see what it is in the traditional classroom procedure that causes the student to feel that he is on the defensive. Perhaps the cause is this asking of questions to see if students have *learned* the answer. If so, then surely one of the best procedures is to reverse the process and let students ask the questions which they would really like to have answered.

At first the students are merely puzzled when told that they may ask their own questions. They usually begin by asking questions over an assignment to see if other students have learned the answers. The teacher can help students learn how to ask questions that are real questions. This can be done by asking for questions at the opening of a new major topic in the course.

For example, at the beginning of the study of earthworms, the teacher may well devote a whole class period to the presentation of student questions. At the opening of the period, emphasis should be placed on the idea that these questions are to be questions that the student really wants answered about earthworms, questions about which the student has wondered, such as: Can the earthworm see? It has no eyes and yet it withdraws into its burrow when a light is flashed on it.

Once the students get the idea, questions come spontaneously. A few questions frequently asked are:

Is that swelling in the middle of the worm its head? If not, where is its head? What is the swelling? How does the earthworm dig its hole and what does it do with the dirt?

Can a worm find its way back to its burrow (students do not call it burrow) if removed some distance from it?

Does it breathe? If so, how?

Does it have a heart?

I often see some red stuff that looks like blood when I put a worm on a hook. Is it blood?

Is it true that you can cut a worm in two and both pieces will live?

All the questions may be mimeographed and a copy given to each student who then selects those questions which he wants to investigate. Each student may proceed with his investigations in whatever way he thinks best. When he runs into difficulties, the teacher may offer suggestions, help him find references, or do whatever promises to be helpful. Such an approach to the subject matter of biology may well be called the problem approach in the real meaning of the term.

The problem approach to biology seems to be the best approach, if the problems posed are real rather than artificial. Merely changing an ordinary title such as "The External Features of the Earthworm" into the question "What are the external features of the earthworm?" does not constitute posing a real problem. Using a question asked by a student as a problem is a very good way to learn how to pose real problems.

Contrast the routine procedure in studying bread mold with the following one. Pose the problem, Where does the mold on bread come from? Discuss the problem. Students will suggest other questions. Does it come out of the bread? Does it come out of the air? How can we find out? If it comes out of the bread, a piece of bread enclosed and sealed in a fruit jar and baked an hour should still mold. Try it to see. If it comes out of the air, what is there in the air that can make mold? Grow some mold in the routine way and examine it under the microscope. The spores will be evident. Are the mold spores in the air? Expose the slice of sterile bread in the fruit jar to the air for half an hour and let it stand for a time. Does it mold? Gradually in solving the problem as to where mold comes from, the student learns all that the old routine procedure teaches him and much more. What is more important, he really learns the factual material without apparent effort, not just to pass a test, which he can now do easily, but because he needs the facts to solve his problem.

One of the most amazing things about building a unit around the student's own questions is that objective tests at the end of the unit prove that he not only has gained a better mastery of the unity idea, but also a better mastery of the factual material in the unit than he gains by any other method. For some reason, a student who wants to know how an earthworm crawls really learns about setae and longitudinal and circular muscles, not by memorizing the terms in isolation but because he needs the terms in order to understand something he wants to know.

The teaching of biology becomes a real pleasure when we learn how to bring our vital subject close to the real lives of students. No one can achieve complete success. Many obstacles that we cannot surmount stand in our way. Nevertheless, there is the constant challenge. We accept the challenge, when we accept a

position as a teacher of biology. Learning how to build our course around problems that are real to the student depends upon finding out what questions or problems exist in his consciousness. Once we learn how to do that, we have gone a long way toward learning how to teach biology so that it really stirs the enthusiasm of the student and functions in his actual living. The satisfaction that is derived from teaching of this type is reward enough for any teacher.

Teaching of Water-Land Transition in Evolution

CLYDE E. KEELER
The Wistar Institute of Anatomy and Biology, Philadelphia

In my thinking about evolution as a college student I got along fine except for one step. I could imagine life starting its eternal miracle in some warm, tidal pool. I could follow its spread into the ocean and its peopling of that enormous realm with invertebrates and vertebrates. I could trace its venture into the mouth of some fresh water stream. But, frankly, I had difficulty in picturing the metamorphosis from a water to a land animal. Surely the environment of the water is more uniform than the land environment, and to a water animal a more pleasant habitat. I could not see why the water animal wanted to get out of the water badly enough even under the drive of population pressure. It appeared to me that to dislodge the comfortable water animal would require some physiologically compelling kick that made the air more comfortable than the water to that particular species.

The professor in my college course successfully guided life up the fresh water stream as usual, and then he showed the picture of a lungfish. He introduced the common argument that the drying of fresh-water pools in the summer caught the water creatures and selected them for air-breathing capacity. As a result, the incorrigibly aquatic individuals died and the more successful air-gulpers lived to greet a subsequent rainy season. But the lungfish hasn't really become a land animal yet. He has merely developed a makeshift device that allows him to encyst in the mud and keep on living at a low physiological level until the rainy season returns.

In my mind there stood out, first, the objection that under the limitations of this argument, if the pool dried up completely just once before the evolving group had achieved lungs adequate for maintaining an air-breathing existence, his race would all die and evolution would have to start all over again! In addition, in all the years in which the pool failed to dry up enough to make him feel the pinch, there was no selection! These were the chief thoughts that bothered me.

However, I believe that a recent genetic cross made by Dr. R. Cranford Hutchinson of The Wistar Institute and described by him in the folder of that laboratory distributed at the recent A.A.A.S. meetings in Philadelphia provides critical data upon the basis of which we can augment our description of this difficult step in evolution, namely, the transition from water to land.

Dr. Hutchinson crossed the land sala-

mander, *Amblystoma tigrinum,* with the non-metamorphosing white Mexican Axolotl. The immediate or F_1 hybrids became land animals. In the second or F_2

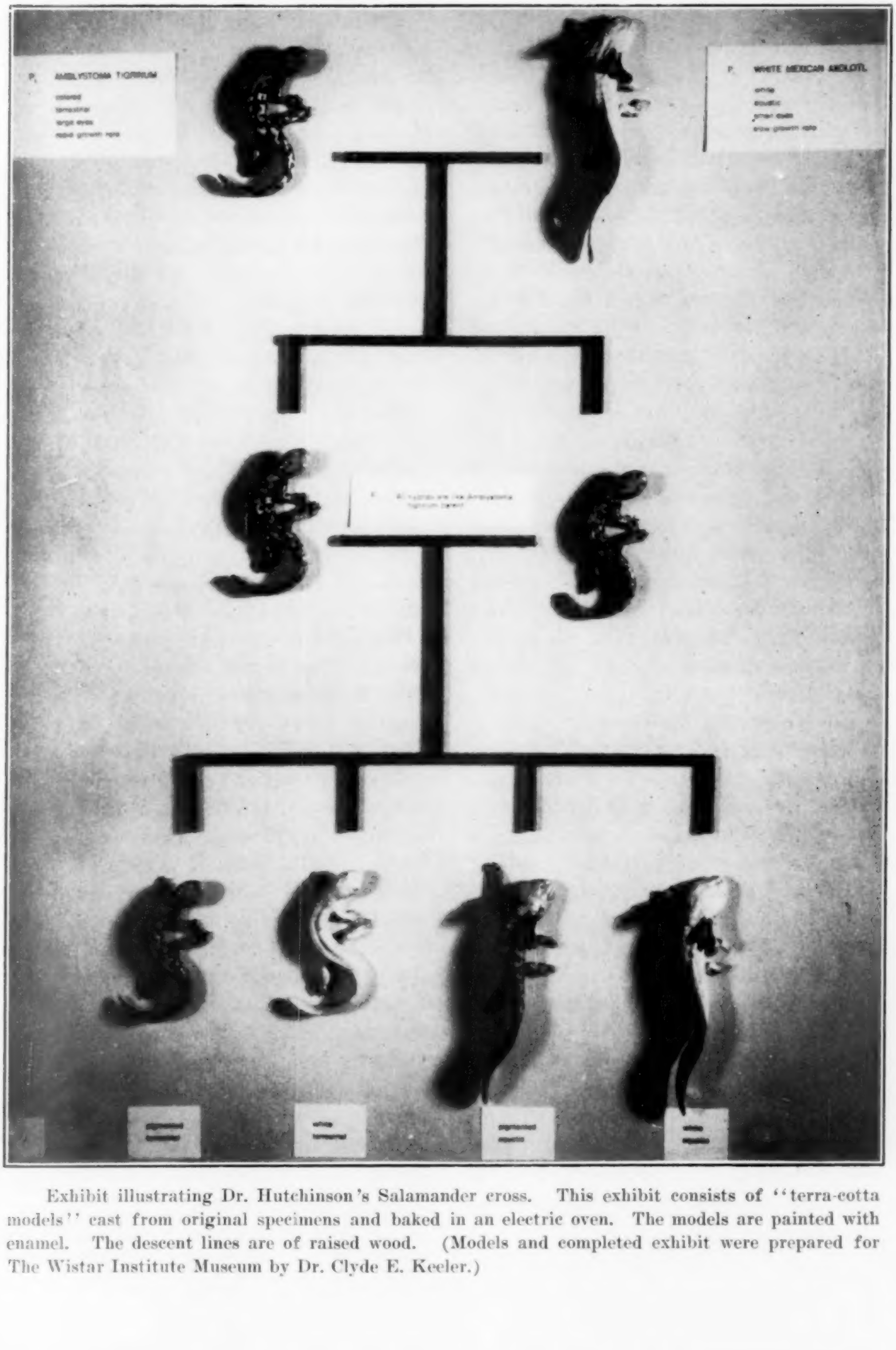

Exhibit illustrating Dr. Hutchinson's Salamander cross. This exhibit consists of "terra-cotta models" cast from original specimens and baked in an electric oven. The models are painted with enamel. The descent lines are of raised wood. (Models and completed exhibit were prepared for The Wistar Institute Museum by Dr. Clyde E. Keeler.)

hybrid generation there segregated both land and water forms, proving that the alternative characters of metamorphosing ability and lack of metamorphosing ability are based upon inherited gene differences.

The geneticist knows that any adaptive gain in evolution must be based on the genes or else the individual that first made this developmental advance could not bequeath it to his progeny. But Hutchinson has shown that the water-to-land gain actually has a gene basis in certain salamanders, which satisfies the geneticists' demand.

It is a common laboratory demonstration to deprive a larval *tigrinum* of his thyroid glands and show that such an operated *tigrinum* remains aquatic.

It is also known that treatment with thyroid will cause axolotls to metamorphose, and hence the axolotl carries latently within its aquatic constitution the capacity of becoming a land animal (including the absorbing of his plume gills and the employment of his lungs) providing that he receives more thyroxin than he ordinarily gets.

The land-going *Amblystoma tigrinum* on the contrary, has symptoms of being an excess thyroid patient, namely: large, bulging eyes, and a faster growth rate. Both of these characteristics suggest a more efficient thyroid in *tigrinum* and that here possibly the natural meta morphosis from water to land is based on thyroid. The corresponding evolution argument runs thus:

The first individual in salamander evolution that was able to gulp air better than his neighbors was able to do just that morphologically because he had the added thyroxin output of a more efficient thyroid gland which was in turn dependent for its greater efficiency upon his receipt (through mutation) of genes determining the development of a few more thyroid cells or of thyroid cells having a larger output.

The greater introduction of thyroxin into his body not only tended to develop the lungs, to reduce the plume gills and bring about other metamorphic changes in the salamander, but its very presence in his physiological system produced an increased metabolism demanding a greater rate of oxygen consumption than that to which he was accustomed. With his gills disappearing as a direct result of natural thyroid treatment, the metamorphosing salamander found that he could not obtain sufficient oxygen from the water by means of these organs.

Therefore, such a thyroid animal actually found that he felt more comfortable at the edge of the water where there was more dissolved oxygen than deep in the pool, and he probably felt the greatest relief when actually gulping into his outpocketing lungs air from which he could obtain the most of this necessary oxygen.

The transition from water to land, then, at least in some salamanders, may be looked upon as an unconscious selection of genes for developing a more efficient thyroid.

This explanation brings the amphibian out of the water gradually without the hazards of drying up fresh water pools in the summer. During unfavorably dry times he could follow the recession of the water in permanent lakes or streams and associate himself with the water generation after generation until he became a completely land-going animal.

I think that this explanation should logically be introduced along with the drying-pool theory, and I believe that it should be suggested to the class that there may have been a number of different successful mechanisms that bridged this gap in evolution.

Homework Assignments in Biology[1]

CHARLOTTE TROSS
South Hills High School, Pittsburgh, Pennsylvania

All of us as teachers have had more or less definite reactions to the recent theories of education and to the various methods by which they have been publicized and by which they have been put to practice. One of my most persistent impressions has been to the effect that in trying to make the school a child-centered school many of us have failed to convey to the child the idea that he, too, must assume some responsibility for himself, that he must cooperate with others—his classmates, his parents, his teachers—and that in order to do this he also must do some work. That work may be of immediate and vital interest to him or it may be plain hard work which must be done to lay a foundation for the future.

The lack of responsibility on the part of many pupils is due to a number of causes. One cure for it may be found, I believe, in continuity of subject matter which must be of definite value to the learner—either of cultural or practical value—and which must be, of course, related to the experiences of the boy or girl.

Too often have I found that the puipil regards learning as something to be done for a particular teacher in a particular room, that it has no bearing upon other activities. For example, good English usage and punctuation belong to the English department and the principles of art belong to the art department and are to be used only in the art room. I do not intend to criticize teachers in other fields. I know that I have failed, too, for too many times have I seen my pupils put pencils in their mouths, use another's comb and bite from one apple!

[1] Presented before the Biology Teachers' Club of Western Pennsylvania, December 7, 1940.

To be functional, a school subject should be met and recognized outside of the class room—at home, during leisure time—in fact at all times. Home work can play an important part in making learning a continuous process.

Home work assignments may take many forms. Definite assignments in texts and references with specific questions to be answered have their proper place, especially for the boy or girl who cannot or will not plan work for himself or herself.

Other assignments may be classified as long term planning:

1. *A study of words* found in text or supplementary reading should be encouraged. Such a study ought to include not only scientific terms but other unfamiliar words as well. Learning to identify roots of words, prefixes, and suffixes is a useful and interesting activity.

I realize that science teachers in general and biology teachers in particular have been severely criticized for cluttering up their subject matter with too many terms, but I believe that when a principle is being taught, it and its fundamental parts should be given their legitimate names. Teachers in other fields are constantly trying to enlarge the pupil's vocabulary. Why should not science teachers do the same since everyone admits that we live in an age of science?

2. *Observations* on characteristics and habits of plants, animals and people may be made and records kept.

3. *Hobbies* can be fostered.

   a. Collections } Along with these,
   b. Nature walks } conservation may be stressed.
   c. Nature photography.

d. Scrap books of current information on all aspects of biological research.
e. Evaluation of advertising propaganda met on the radio and through the press.

4. *Critical observation* on *personal health habits* without engendering morbidity or worry should be encouraged. To mention a few:

a. Keeping fingers, pencils, etc., from the mouth.
b. Having respect for the personal property of others. For example, a pupil may be trained not to embarrass another person by asking to borrow a personal object.
c. Keeping away from others when one has an infection of any sort and when others have infections.
d. Selecting suitable meals, especially at the school cafeteria where the pupil has free choice.

5. *Observations* on the probable influences of heredity may become fascinating.

6. *Study of superstitions and ignorant practices* may be helpful as well as interesting.

7. *Experiments* within the realm of possibility are worthwhile; for example, chemical gardens, balanced aquaria, balanced terraria.

8. *Supplementary reading* should be encouraged; especially biographies of scientists.

9. There should be access to *current publications*, such as

a. Hygeia
b. Popular Science Monthly
c. Science News Letter
d. Science Leaflet
e. National Geographic
f. Nature Magazine
g. Current Science
h. Reader's Digest
i. Good Housekeeping
j. Ladies Home Journal
k. Harpers
l. Forum
m. New York Times
n. Local newspapers

Pupils may select any one or more of these projects and make a written or oral report or both at the end of a semester or other designated time. Some of these projects can be carried on through life, of course.

Sometimes home conditions are not conducive to profitable study. Each boy or girl should, of course, have some space at home, however small, for his or her own use, such a space never to be molested by anyone. Cooperation of both parents and pupils must be sought for effective study.

I believe that homework assignments for Mondays should be light and that they should be omitted over holidays for obvious reasons. It is sometimes expedient to give assignments for several days in advance so that a pupil may learn to work out an effective study schedule.

A set of guiding statements for successful home study may be helpful to pupils. W. S. Monroe, in his book, "Directing Learning in High School," has summarized several sets of suggestions. These suggested guides apply primarily to textbook assignments:

1. Successful study is difficult in a room which is not warm, well lighted, well ventilated, and otherwise physically comfortable. Successful study is difficult in a room where there are other persons, or where there are disturbing noises or objects. Thus, the first step to be taken is to provide a physical environment which will not interfere with effective study.

2. Make out a daily schedule in which you assign a regular time and place for the study of each subject.

3. Plan to study an assignment as soon as possible after the assignment is made. Then review the lesson briefly just before going to class. Do not wait to study a lesson until just before entering the class room because you will have difficulty in remembering later what you study.

4. Before you start studying a lesson, collect all of the texts, references and other materials you need so that your work will not be interrupted.

5. Begin your work as soon as you sit down, with the determination that you will keep your mind on your lesson, that you will study for all you are worth, that you will complete your task as quickly as possible. Do not waste time in getting started.

6. Begin your study by reading the main points of the previous lesson and then get clearly in mind the assignments which you are to study.

7. At the end of your lesson, summarize briefly what you have learned. In this summary the most important points should be clearly stated. Usually the summary should be written.

8. Watch carefully for items you are unable to understand and check them for the purpose of asking the teacher for an explanation. Plan to ask your teacher at least one good question on each lesson.

9. Keep studying until you are certain that you have your lesson or know just what the trouble is.

I should like to add that I believe that an informational outline or tabulated information is a valuable means of study.

The problem in education which I have found a little irksome seems to be on the verge of being solved—and through no effort of any educator. I refer to the idea which has been prevalent so long among theorists in the field of education and among teachers, too; that is, that the responsibility for learning rests almost solely with the teacher, who is expected to maintain a high pitch of interest in his or her subject so that there need be a minimum of effort on the part of the pupil. Of course, it must be very pleasant to the learner when learning is made easy. There are, however, some phases of learning which require real effort.

Now, with the turn of events in the world at large, all of us are discovering that we owe something to the democracy in which we so gratefully live. We must begin to repay that debt at once and we must begin to pay the debt by working harder. That work must be shared by everyone regardless of age or station. I believe that work for work's sake and for pride in accomplishment can now be reintroduced into our schools!

THE SEVEN SEAS IN EVERY LABORATORY

Several months ago I published an account of a method we have found useful in collecting and for the study of the smaller aquatic biota.[1] Living material, in balanced relation between green plant and animal forms, from fresh-water sources as also from the sea, is placed in large test tubes. (Ours are seven inches long by one and one-quarter inches in diameter.) The tubes are partly filled with water to which relatively small quantities of living material are added. Tubes containing fresh-water forms have their thin corks pierced with a one-fourth inch "breather" hole for gaseous exchange and for the addition of water with a pipette when necessary.

The principal value of the method is that the material may be handled and studied day after day in the containers in which it was collected. Contrary to one's first expectation, the plants and animals will continue living for many weeks. The tubes, standing in holders provided by boring holes in a thick board, are merely kept warm and in the light of an east window. One tube had thousands of colonies of *Volvox* for over

[1] Givler, J. P., "Test-tube Aquarium and Nine-power Lens," *Turtox News*, January, 1941, pp. 1–4.

two months. Others contain *Nitella, Utricularia, Elodea,* or *Spirogyra* as the green plant, with small fresh-water snails, *Hydra*, or entomostraca to supply the balance of animal metabolism. It is remarkable how well these organisms get along together in such small quantities of water, and how normally the activities of the several forms progress.

We have found recently that the test-tube aquarium is as well or even better adapted to marine life than to that of fresh-water. On Dec. 20, 1940, Dr. A. D. Shaftesbury "stocked" five tubes with plant and animal material at our laboratory at Beaufort, North Carolina. Each was filled about two-thirds full of sea-water to which some green marine algae such as *Ulva* or *Enteromorpha* were added. These green plants composed about ten per cent or less of the volume of the water. A much smaller bulk of active animal life was then added, such as a small nereid worm, mollusk or small sea-anemone. The tubes, still tightly corked after an automobile journey of 250 miles, are kept at room temperature on a window-sill. Two of these little balanced marine aquaria throve for nearly three months and one remained in good condition for 108 days. We have not added a drop of water to any of these marine tubes and the corks have not been removed except for a few minutes, at long intervals, to note the odor. While the contents remain living, each tube smells just like seaweeds at the beach. In the warmth of the sunshine some of the water in the tubes evaporates, saturates the confined "atmosphere" above, condenses later in drops which rain down on these microcosmal "seas" in their inland isolation. Each morning of sunshine also sees the algal masses buoyed up by numerous entrapped gas bubbles resulting from photosynthesis.

As we have found, corked marine tubes, with reasonably good balance between plant and animal forms, will run for three months or more. This being true, there is no good reason why we should not be able to import tubes stocked at Roscoff, Plymouth, or Naples. Hitherto collectors have brought back principally dead material. Now, collectors may secure microscopic forms as well as other of the smaller aquatic biota and send them long distances to be kept alive and studied in the water in which they lived in nature. The day will come when, in suitable containers admitting light while in transit, steamships or clipper planes will be able to bring us tubes stocked in Ceylon, or at Melbourne, Yokohama, Honolulu, Valparaiso, Buenos Aires, or Capetown.

J. P. GIVLER,
*The Woman's College,
The University of North Carolina,
Greensboro, N. C.*

MAKING CLASSROOM CHARTS

Do you make careful blackboard diagrams and after using them a few periods erase them? Have you felt the desire to keep some of them for future use? Do you have an insufficient number of charts: diagrammatic, graphic, representative, or pictorial? Would you be willing to pay about 20 cents for charts of permanent value? If so, then here are some ways to do something about it:

1. Obtain some muslin, window-curtain material, sign cloth, or specially prepared map or chart cloth. The first three may be obtained at a department store while the others are available from supply companies or manufacturers.

2. Make your diagram, or whatever you wish to prepare, on the chart ma-

terial, using a soft lead pencil. Several schemes may be used.

(a) Draw free-hand if you can obtain satisfactory results.

(b) Use a pantograph to reproduce, enlarge, or reduce what you have found and modified.

(c) Use an opaque projector (reflectoscope) to project your diagram to the chart material and then sketch it from the image.

(d) Trace the diagram on cellophane, ground glass, or translucent film. Use this between glass plates or unmounted in a projector as a means of obtaining an image of proper size for sketching.

(e) Photograph the copy and use the negative in a projector. Sketch from the image seen on the chart material used as a screen.

3. Ink, title, and label your sketch using black or colored India ink. Clean with art gum.

NOTE: In case of muslin, you may prepare your sketch with wax crayons or pencils and then set the colors by ironing on the reverse side. This results in a washable chart.

4. Use the chart as it is or color with wax crayons and spread the color with carbon-tetrachloride, benzene, or gasoline. Colors may be blended as desired.

Pupils like to prepare the charts. Many can prepare them with amazing skill and satisfaction.

PHILIP G. JOHNSON,
Cornell University,
Ithaca, New York.

INDIANA BIOLOGY TEACHERS ORGANIZE ON STATE BASIS

On Thursday, October 23rd, the Biology Section of The Indiana State Teachers Association, meeting in Indianapolis, laid the basis for a state association of biology teachers. They applied for affiliation with *The National Association of Biology Teachers*, appointed a committee on constitution, took a membership roll, and elected the following officers:

President—Miss Margaret Mullendore, Anderson High School, Anderson, Illinois.

Vice President—Mr. Robert L. Black, Emmerick Manual Training High School, Indianapolis, Indiana.

Secretary—Miss Charlene Rector, High School, Muncie, Indiana.

The impetus for this forward step can be credited to Mr. Prevo L. Whitaker of Terre Haute, Mr. A. B. Krom of Wabash, Mr. H. H. Michaud of Fort Wayne, Mr. A. L. Smith of South Bend, and Miss Dorothy Miller of Vincennes, in addition to the elected officers mentioned above.

The speaker on the program for the meeting was Dr. D. F. Miller of The Ohio State University who spoke on the teaching of biology in the United States and the needs of biology teachers which have been revealed by the questionnaire prepared by Dr. Riddle's Committee.

CONSTITUTION AMENDED

The proposed amendments to the Constitution of *The National Association of Biology Teachers*, as published in THE AMERICAN BIOLOGY TEACHER, April 1941, have been acted upon favorably by the Executive Board. The most important change introduced by these amendments consists in the establishment of a new governing body, known as the Representative Assembly. Under the present Constitution each affiliated local organization is entitled to send one delegate with the power to vote in the Representative Assembly.

President's Page

This month there are two subjects that I would like to mention. The first one is the meeting in Dallas. It is very seldom that the annual meeting of the A.A.A.S. is held in the South and that means that this year the people of that region will have the opportunity of attending the meetings more conveniently, or perhaps I should say, less expensively. Our organization, being associated with the A.A.A.S., has gone with it each year. This gives to our members of that section of the country the same advantage as to members of the A.A.A.S.

I have heard a few remarks to the effect that this year's meeting is being held for those people of the West. Certainly they have an advantage that they seldom have, but they still do not have the advantage over the New Yorker or the Philadelphian. It is hard to realize that New York is closer to Dallas than is San Francisco. Then let us all be there —East and West, North and South— and have the biggest get-acquainted meeting of our history. If you will take a look at the program that Mr. Russell has prepared I am sure you will want to hear it as well as to meet your fellow members.

The second subject concerns our membership. Not long ago Mr. Houdek sent me a copy of the membership file as it stood at the beginning of this fiscal year. Illinois heads the list with the most members, then come Pennsylvania, New York, Ohio, and California. Only two states, Wyoming and North Dakota, were without representation—a black mark on an otherwise clean slate. But to make up for that, five United States territories and six foreign countries receive our Journal.

These facts may be changed by now, but they serve as an indication of the wide circulation our Journal has. They should also indicate the far-reaching effect that we as a National, almost international, organization can have. If your state does not have an affiliated group, we wish that you would let us know that you are interested and we will gladly help in organizing one. That would help both the local and the national situation and the greater the group, the better the results that can be accomplished.

Then here is a toast to, and a best wish for our affiliated locals and our members during the coming year wherever they may be—Alaska, South America, Sweden, Mexico, Hawaii, Canada, or in the United States.

H. A. S.

ANNUAL BUSINESS MEETING OF NATIONAL ASSOCIATION

The annual business meeting of *The National Association of Biology Teachers* will be held in the Hotel Jefferson on Sunday, December 28 beginning at 9:30 in the morning. The Executive Board is asked to be there if at all possible and an invitation is extended to all of the affiliated locals to send a representative. If any member has a business matter to be presented at that time will you please write our president so that he may include it on his list of business.

In order to facilitate prompt attention to requests for room accommodations at the Dallas meeting members are asked to mention in their letters that they are attending a meeting of an association affiliated with the A.A.A.S.

H. A. S.

Fourth Annual Convention

of the

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

in conjunction with

The American Association for the Advancement of Science

meeting at Dallas, Texas, New Year's Week, 1941

PROGRAM

General Meeting for Members and Friends, Monday, December 29, Roof Garden, Jefferson Hotel

MORNING SESSION 9:30 A.M.

1. Amphibia (20 minutes, illustrated)
   Ottys Sanders, Southwestern Biological Supply Co., Dallas, Texas
2. Contact Dermatitis from Common Vegetation (20 minutes)
   H. L. Graham, Highland Park High School, Highland Park, Texas
3. An Individual Philosophy of Conservation (30 minutes)
   Rudolf Bennitt, University of Missouri, Columbia, Missouri
4. The Museum and Biology (20 minutes)
   F. Martin Brown, Fountain Valley School, Colorado Springs, Colorado
5. Experiments to Demonstrate Some of the More Difficult Phases of High School Biology (20 minutes)
   Ruth Morris, Sunset High School, Dallas, Texas

AFTERNOON SESSION 2:00 P.M.

1. The Biology Teacher and Health Education (20 minutes)
   J. M. Coleman, Texas State Board of Health, Austin, Texas
2. Yellow Fever, Plague, and Typhus—Smouldering Threats (30 minutes, illustrated)
   Asa C. Chandler, Rice Institute, Houston, Texas
3. Reforestation and High School Biology (30 minutes, illustrated)
   Miss Lida Rogers, Holland High School, Holland, Michigan
4. The Influence of Biology on Theories of Personal Conduct (20 minutes)
   Frank J. Bruno, Washington University, St. Louis, Missouri
5. Possibilities for Solving Certain General Problems of Biology Teaching in Secondary Schools (20 minutes)
   Oscar Riddle, Carnegie Institution, Cold Spring Harbor, Long Island, New York
6. Preparing Material for Moving Pictures (20 minutes)
   E. Laurence Palmer, Cornell University, Ithaca, New York

BANQUET

Monday Evening, December 29, 6:30 P.M., Jefferson Hotel. $1.25

Address: "Biology, Appraisal and Forecast"

Dr. Walter F. Loehwing, Professor of Botany, State University of Iowa

President, Homer A. Stephens, University of Wisconsin, Madison

Program Chairman, M. A. Russell, Junior High School, Highland Park, Michigan

Secretary-Treasurer, P. K. Houdek, Township High School, Robinson, Illinois

Headquarters at the Jefferson Hotel

Achievement Tests in Biology[1]

DONALD R. PREDMORE
Dormont High School, Pittsburgh, Pennsylvania

Tests are becoming more specialized today than ever before. Different groups of tests are being more closely applied to the particular fields which they are designed to measure. Among the groups of tests now existent we find aptitude tests, attitude tests, intelligence tests, tests used in vocational guidance, achievement tests, and other kinds. For those actively concerned with the teaching of biology, achievement tests are probably of greatest interest. It is that phase of testing which will, therefore, be considered here.

If we refer back to the history of achievement tests for a few moments we find four general types of measurement have been outstanding at various periods. The earliest form, which was used more than two thousand years ago, was the oral questioning or Socratic Method. Next came the written examination, which, according to the best records, was used in China some thirteen hundred years ago. The written examination is now called the essay test or traditional examination. Since 1900 the standard test has appeared in ever increasing numbers. At the present time more than a thousand different standardized tests have been prepared, and millions are sold each year. Teacher-made objective tests have come into use widely since 1920, and to this type of test further reference will be made later.

It is a rather unusual fact, when one considers it, that none of these types of measurement has been dropped. They have changed the nature of their usage, but they are still retained in our teaching techniques today. Oral questioning is no longer used very extensively as a method of testing. It has become a method of teaching. Essay tests have decreased rapidly in their usage since the advent of objective tests. Nevertheless, writing in a good many forms, somewhat comparable to essay tests, continues to be a major classroom activity.

At first the use of standardized tests was attempted in all kinds of classroom situations, but now they are being used more exactly for the purposes for which they were intended. They are primarily semester and year-end examinations, and they do not lend themselves readily to any other kind of use. The appreciation of this fact has made teachers realize that they are somewhat inflexible. For a complete measuring program a teacher requires tests which will measure blocks or units of the subject matter at regular intervals as well as year-end examinations. Frequently it is necessary for several different textbooks to be used in a course if a particular standardized examination is to be taken by the pupils. Then there has been the question of cost for standard tests. Many school districts have not felt able to purchase the tests in large numbers, because of reduced tax revenues and added economic burdens in recent years. Although standard tests do have some very definite values, the foregoing reasons will indicate why teacher-made tests have gained steadily in popularity.

Since 1920 the preparation of objective tests by teachers has increased greatly. Many of the early teacher-made tests were not well prepared. Colleges began to give instruction in the methods of pre-

[1] Presented before the Biology Teachers' Club of Western Pennsylvania, December 7, 1940.

paring objective tests, and, within a few years, a marked improvement was noticeable in the quality of the tests. The validity and reliability of the tests was increased, a higher degree of objectivity was attained, easier methods of administering and scoring were used, and the tests paralleled more closely the materials taught.

In 1932 the "Thirty-first Yearbook" was published by The National Society for the Study of Education. It has affected very extensively the unit arrangement and the subject matter in biology texts. This change shifted the emphasis not only in texts but also in biology tests. A number of new biology textbooks have appeared on the market since that time, and most of them have used the unit and problem arrangement instead of chapters and sub-headings. The authors of some of these books have later produced unit tests to accompany their texts. These unit tests are not standardized, but some of the preliminary steps toward standardization have been used in their preparation.

The "Dynamic Biology" which is used so extensively in this district now has a complete set of unit tests to accompany it. The text entitled "Everyday Problems in Biology" has a booklet of tests which closely parallels the units and subject matter of the book. A third text, with the title "Exploring Biology," has a more comprehensive series of tests for classroom use. The preparation of a nearly complete measuring program for a one-year course in biology has been attempted. No semester or year-end examinations have been included, however. A part of each unit test is designed to test scientific thinking. The evidence to support tests of scientific thinking has not as yet been very conclusive. Apparently there is a need to develop, if possible, such a method of thinking among the students of a science. If a question designed to test this function requires the reading of a paragraph of exact scientific statements, and the remembering and understanding of each one, it is probable that such a question would be measuring the ability of the pupil to read as well as to think scientifically. The idea of a complete measuring program prepared by experts is very much worthwhile, however. Experimental evidence indicates that carefully prepared tests given at one or two week intervals improve the quality of instruction.

The statement is frequently made in texts on measurement and in educational magazines that the tests prepared by teachers do not have a sufficiently high degree of validity and reliability. It has also been occasionally suggested that if teachers had more practical training in test construction they would make better tests. A research was carried out on this question by Sterling G. Brinkley of Columbia University. He found that teachers improved rapidly in their ability to prepare objective tests after a short period of training. With the idea that they might be helpful to teachers who frequently have to prepare tests a list of general principles to be observed in test construction are submitted below for your consideration:

Principles to be observed in order to increase the validity and reliability of a test

1. Good sentence structure and correct usage of words are necessary.
2. Test items which cannot be answered by any of the pupils should not be included.
3. Items which can be answered by all of the pupils are valueless for measurement.
4. "Tricky" or "catchy" questions are undesirable in a test.
5. A test should begin with questions which are not difficult.
6. The general arrangement of the questions from easy to difficult will increase both validity and reliability.
7. Directions should be included in the test

which are both fully stated and easily understood.

8. The use of samples and preliminary practice questions increases the validity of the items.

9. Prepare more items than you expect to include in the test, then choose the more valuable ones.

10. Increasing the length of a test increases the validity of the test.

Other desirable factors to include in the preparation of the test

1. In order to prepare an objective test use only objective type questions such as true-false, multiple choice, matching, and so forth.

2. To be objective an item should not permit differences of opinion to enter into the scoring of it.

3. Adequacy of sampling will give greater reliability. Extending the test will improve the sampling.

4. Prepare the test so that it can be administered and scored easily.

5. Duplicate forms of tests are desirable if it is possible to prepare them.

REFERENCES

BAKER, ARTHUR O., and MILLS, LEWIS H. *Dynamic Biology.* New York: Rand McNally and Company, 1938. 733 pp.

BRINKLEY, STERLING G. *Values of New Type Examinations in the High School.* Contributions to Education, No. 161, Ph.D. Thesis, Teachers College, Columbia University, 1924.

PIEPER, CHARLES J., BEAUCHAMP, WILBUR L., and FRANK, ORLIN D. *Everyday Problems in Biology.* New York: Scott, Foresman and Company, 1932. 686 pp.

Program for Teaching Science. *The Thirty-first Yearbook of the National Society for the Study of Education, Part I.* Bloomington, Ill.: Public School Publishing Company, 1932. 370 pp.

SMITH, ELLA THEA. *Exploring Biology.* New York: Harcourt, Brace and Company, 1938. 696 pp.

Color Changes in Frogs

WALTER A. THURBER
Cortland Normal School, Cortland, N. Y.

As changes take place in external conditions, some organisms respond by change in color. The chameleon has acquired legendary fame in this respect. There are also others, native of our own country, which are equally deserving of attention and which make fascinating study for elementary and secondary school pupils.

The wood frog (*Rana sylvatica*), the tree toad (*Hyla versicolor*), and the spring peeper (*Hyla crucifera*) are capable of rapid color changes when shifted from light to dark surfaces or from dark to light surfaces. Most other frogs show similar but less marked changes; for instance, pickerel and leopard frogs are much darker in spring as they emerge from the mud than they are later when they frequent grassy places.

The mechanism by which rapid color changes are brought about, lies, in part, in certain cells bearing dark pigment (the melanophores). Two theories suggest that perhaps (a) these dark-pigment cells expand amoeba-like by sending out numerous processes, or (b) the cell processes are permanent and the pigment migrates into or out of these processes. When the dark pigment lies out in the extended processes, it masks other types of pigment cells. The general color is, then, dark. But when the dark pigment is withdrawn into the main body of the dark pigment cells, other colors can be seen and may predominate.

Little has been done with color changes in American amphibia, and the interested student will find the changes in American frogs an almost unexplored field. Such researches as have been carried out with various amphibia have

discovered several factors that affect changes in different species. Some of the factors are temperature, moisture, light intensity, background color, and background texture. Thus the pickerel and leopard frogs referred to may be darkened in winter by either low temperature, low light intensity, dark background or excessive moisture, or possibly by all these factors combined. Such work as has been accomplished up to 1931 is briefly summarized in "Biology of the Amphibia" by G. Kingsley Noble.[1]

To carry out a roughly qualitative experiment, place a peeper or a wood frog on a dark surface for a certain length of time, say, fifteen minutes. The animal may be kept in a Petri dish or small beaker. At the end of this time note the color, and shift the animal to a light surface. After an equal interval compare the color with the previous observation.

Pupils soon discover that more objective measurements are desirable; that they can put little dependence upon memory or upon verbal descriptions of color. To provide for such measurements one may buy elaborate color charts designed for this purpose. One may also procure simpler charts such as those used by stamp collectors. The color charts included in mail order catalogs are excellent substitutes. These last should be kept in black paper envelopes, such as those containing enlarging paper, in order to prevent fading.

In using a color chart, it is necessary to cover all but one color square so that the eye will not be distracted by the other colors. To make a mask for the chart, cut in a card an opening exactly the size of one color square. This opening is to be placed over different color squares in turn until the matching color is found. The number of the color square can then be recorded.

Many problems will present themselves to alert biology pupils. These problems require little equipment and little supervision, and so are well adapted for use as optional problems. It will also be found that these problems are excellent for developing the scientific spirit.

One possible problem involves the length of time necessary for color changes to take place. Another problem tests the ability to match backgrounds of different colors. The effect of different colors of light filtered through colored cellophane may also be discovered. If a photometer is available the effect of different light intensities can be tested. The effect of temperature upon rapidity of color change makes another interesting study.

It is necessary that both pupils and teachers recognize the limitations of the data collected. People often forget that a truth proven for one situation may or may not hold in another situation. For instance, in the above experiments, artificial situations are involved. To say that the response of the frogs in natural situations is the same as that occurring in these experiments is to generalize without adequate basis.

The work should lead into field studies. Pupils ought to carry out and record observations of frogs under natural conditions. Broader generalizations are thus possible, although, of course, the need for suitable qualifications is never eliminated.

[1] McGraw-Hill Book Co., New York, 1931.

Biology Teaching in the United States: Community Backgrounds and School Organizations: Data from a Questionnaire

BENJAMIN C. GRUENBERG
New York City

(Concluded from November)

A high degree of organization among the parents does not necessarily indicate either a high degree of active concern with school matters, or a high percentage of helpfulness. The schools in the Southern states have the largest percentage with associations (79.6%), and a low index of "indifference." But they have also the largest percentage of "harmful" associations (3.6%) as well as of "helpful" ones. Similarly, the Western states, with organizations in 70.9% of the schools, show much activity—an index of "indifference" of only 67.0%—but judged to be "harmful" in 3.4% of the cases. In contrast, only 1% of the parental associations in New England schools are considered "harmful" (1 in 97).

In general, where parent-teacher associations have been long active, we may expect a more intelligent and more objective and public-spirited attitude. This we may take to represent one hopeful outcome of the consistent extension of public schooling.

The promotion of teachers. Biology teachers were asked to report on the methods of promoting teachers practised in their respective school systems. Four types of promotion were suggested; and spaces were left for "other" bases. In many schools or systems two or more criteria or considerations influence promotions. For this and other reasons the tabulations cannot be checked too closely for percentages, or for complete reports. Thus, we have a total of 81 schools or systems that base promotions on examinations, whereas the regional distribution shows only 72; and while the total of schools or systems in which politics and favoritism count is 58, the regional total shows 70 (see Table 5).

The tabulated information suggests that by far the most frequent basis for promotion is "successful teaching," with a tendency for training and previous experience to be considered next in importance, although "seniority" is not far behind. In only 81 communities or school systems (replies) are examinations used as a basis for promotion. These are all public schools: three are in towns, the rest in cities. Seventy-two of the schools or systems that rely upon examination to select teachers for promotion are in the Middle Atlantic states, the rest are scattered.

Politics and favoritism play a small role in the total. The variation, however, may be significant. None at all is reported for private or parochial schools. The average for the public schools (on the basis of the regional figures) is 2.3%.*

* The calculation of "percentages" of schools

TABLE 5

Basis for promotion of teachers

	Prev. exper.	Seniority in school	Training	Successful teaching	Examinations	Politics, Favoritism
Totals	610	595	684	1,209	81	58
Towns	148	138	172	315	3	21
Rural	188	136	175	427		2
Cities						
Special	39	61	45	72	76	14
Large	120	139	132	183	76	14
Small	124	151	151	188	2	21
Public	580	564	630	1,113	81	58
Parochial	20	13	25	36		
Private	10	18	29	60		
Regional (Public schools only)						
New England	35	27	27	61		7
Middle Atlantic	132	119	137	225	72	15
Southern	87	61	88	140		32
Central	248	263	297	538		8
Western	79	94	81	150		8

The regional distribution is perhaps more significant, showing variation from 0.6% in the Central states to 7.8% in the Southern states.

SCHOOL SYSTEMS AND ORGANIZATIONS

The movement to reorganize the elementary and secondary schools on a "6+3+3" pattern started about the time of the first world war. Nearly half the high schools are still on the traditional 8+4 plan. This may of itself be unimportant for our purpose except as an index of the rate at which new plans and curricula are adopted; this in turn would presumably have some bearing on how energetically the schools are adjusting themselves to present-day needs. The school systems represented by the 3,209 schools (replies) included in our reports were divided into three groups on the basis of their grade-separations—*i.e.*, 8 grades + 4 year high school; 6 years + 3 years junior and 3 years senior high school; or otherwise.

		8+4	6+3+3	Other
Total	3,209	1560	1137	512
		48.6%	35.4%	16%
		(100: 72)		

The information received in reply to this question was broken down as follows: Town and rural; small cities, large cities; public, parochial and private schools; by states and regions.

(1) The first of these divisions gives the values shown in Table 6.

TABLE 6

Types of school organization in rural and urban systems

	Total	8+4	6+3+3	Other
Towns	(751)	369	243	139
		49%	32.5%	18.5
		(100: 65)		
Rural	(982)	553	233	196
		56.3%	23.7%	40%
		(100: 42)		

We can understand that the rural schools would in larger proportions follow organization plans that deviate from

or systems in which favoritism or politics appear to the teachers reporting to play a part in determining promotions was based on the aggregates of the numbers in each horizontal line in Table 5. Although the figures are not very reliable, the extreme variations among these percentages may be significant.

either of the two prevailing patterns. If we disregard the "Others" (largely the 7+4 formula used in the South) we find that the towns in general use the older and the newer organizations in about the same proportions as the school systems of the country as a whole (100:72 for the country at large and 100:65 for the towns). Among the rural schools, however, the 6+3+3 formula guides the organization in only about two-thirds as many schools as in the country as a whole.

(2) The cities have relatively fewer of the irregular organizations, as we might expect. The distribution of the three classes of organization is shown in Table 7.

Compared to the country's ratio of 72 6+3+3 schools for 100 8+4 schools, the small cities have 169, the large cities 108, and the nine selected cities only 85. From this we might infer a greater mobility in the school systems of the smaller cities. In the small cities, however, as well as in the rural communities, the large proportion of 6+3+3 schools is likely to be due to the rapid increase in the number of new schools, especially new junior high schools, which would follow the new fashion, rather than to any systematic transformation.

(3) The relative number of private and parochial schools is small, and not enough appear in the reports to affect the totals seriously. Such differences as do appear, however, are interesting and may be significant. Both parochial and private schools seem to keep the traditional pattern. The three categories are shown in the upper half, and the regional distribution (of public schools only) on the lower half, of Table 8.

(4) In the absence of more detailed information the regional distribution of two major types of organization may be tentatively interpreted as follows: If we disregard the irregular organizations (16% of all the schools) we find that the 6+3+3 type of organization has developed more rapidly in the Eastern part of the country. The New England, Middle Atlantic and Southern states (about 40% of the schools reporting) have 8+4 school organization and 6+3+3 organization in the ratio of 100 to about 94 or 95 (as against 72 for the entire country). In the Western states the ratio is 100:62, and in the Central states 100:58. The Southern states, however, have more than twice their share of schools with some "other" than the two standard types—34% as against 16% for all school systems reporting.

The high ratio of 6+3+3 figures suggests that recent enlargements of secondary school systems have taken place along the lines of the more modern pat-

TABLE 7

Types of school organization in urban communities

	Total	8+4	6+3+3	Others
Nine special large cities (see Table 2)	(317)	178 (56.1%)	134 (42.2%)	5 (1.7%)
		(100: 85)		
Total other large cities	(645)	288 (44.7%)	312 (48.3%)	45 (7%)
Total small cities	(582)	193 (33%)	326 (56%)	63 (11%)
		(100: 169)		

tern. On the other hand, only 9% of the school systems in the western states have organized in "other" than the standard forms. Yet here the ratio of 6 + 3 + 3 systems is the lowest. This suggests that the organization pattern in the communities that developed their secondary schools many years ago has persisted. This view is supported by the records of California, Colorado, and Texas in which the population has grown very rapidly and the proportion of 6 + 3 + 3 schools is very high.

TABLE 8

Types of school organization (a) in public and other schools, and (b) in various regions

	Total	8 + 4	6 + 3 + 3	Other
Public	(2,960)	1,403	1114	443
		(100: 79)		
Parochial	(92)	82	3	7
		(100: 4)		
Private	(157)	75	20	62
		(100: 26)		
Total	(3,209)	48.6%	35.4%	16
		(100: 72)		
New England	(192)	80	76	36
		(100: 95)		15%
Middle Atlantic	(781)	341	319	121
		(100: 94)		15%
Southern	(381)	129	123	129
		(100: 95)		34%
Central	(1,471)	790	491	190
		(100: 62)		13%
Western	(384)	220	128	36
		(100: 58)		9%

(5) There is at any rate reason to suspect that the organization pattern will be related to the curriculum, even if in very many communities the 6 + 3 + 3 formula had been urged upon the public as an economy measure. That is to say, it appeared that money could be saved by consolidating grades 7, 8 and 9 into one building which would be cheaper than more high-school buildings, and cheaper to operate since so many pupils were leaving entirely at the end of the 9th grade. So far as concerns an extension of science teaching, we might expect more progress in areas that have adopted the 6 + 3 + 3 organizations in large proportions. The ratios, however, are not consistent.

A THREE-YEAR SCIENCE PROGRAM IN JUNIOR HIGH SCHOOLS

In reply to the question whether or not the schools offer a science sequence in grades 7, 8, and 9 there were 2,687 replies. Of these, 1,155 reported having a three-year science course, equal to 43%; and 1,532 not having such courses, or 57 per cent. On the basis of offering or not offering such a sequence, the returns are classified according to types of communities in Table 9.

TABLE 9

Three-year science sequence in various types of school systems and in various regions

Region	Totals	Having 3-year program		Not having 3-year program	
		Number	Per cent	Number	Per cent
Total U. S.	(2,687)	1155	43	1532	57
Towns	(703)	311	44	392	56
Rural	(883)	338	44	495	56
Cities					
Nine special	160	77	49	83	51
Total large	411	180	44	231	56
Small cities	518	231	45	287	55
All public schools	(2,515)	1110	44	1405	56

Fewer than half the school systems upon which we have information offer a three-year science sequence—only 43%. The percentage for the public schools is somewhat higher—44. As between town schools and rural schools, no difference is indicated. The nine largest cities show the highest percentage (49) of schools with three-year science courses; but the other large cities are in this respect behind the small cities—the percentages being respectively 43 and 45.

The small number of parochial and private schools affects the general figures

very little, but the information at hand suggests a significant lag in the introduction of science teaching in them. In every region, both parochial and private schools show a disproportionately small number having three-year science courses (37% or less).

Regionally there is no marked deviation from the average with respect to the three-year science course, except for the Western states, as shown in Table 10.

TABLE 10

Percentages of public schools offering three-year science courses, in the various regions

Region	Total	Three-year science course	No three-year course
New England	(137)	66 (48%)	70 (52%)
Middle Atlantic	(586)	291 (49%)	295 (51%)
Southern	(333)	132 (40%)	201 (60%)
Central	(1146)	528 (48%)	618 (52%)
Western	(314)	93 (31%)	221 (69%)

THE AVERAGE LENGTH OF THE SCHOOL YEAR; AND THE AVERAGE LENGTH OF THE CLASS PERIOD

The average number of weeks in the school year, for all the schools reporting was 36.9. With increasing urbanization and industrialization there has been a tendency to lengthen the school term. Although this is usually determined by statute, the rural and town schools in all regions have a somewhat shorter school year than the urban communities. The parochial and private schools also usually have shorter school terms than the public schools but they tend in general to approach the usage in their immediate regions.

The average class-room period is 50.6 minutes. There is great variation in the length of the classroom period among different types of schools and in different parts of the country. In general, however, large city schools, which have special internal traffic problems, tend to have shorter periods (45 minutes), whereas the smaller schools in town and rural regions have longer periods (50 to 55 minutes). (For comparison of information regarding courses and units of instruction, the figures have been transmuted into 60-minute hours.)

A breakdown of the information is shown in Table 11.

TABLE 11

The amount of schooling offered by high schools

	Average number of	
	Weeks in school year	Minutes in class period
Total for schools reporting	36.9	50.6
Towns	34.5	52.2
Rural	35.9	51.8
Cities		
Special large cities (9)*	39.1	43.9
Total large cities	38.6	46.5
Small cities	37.6	54.1
Public schools	37.0	50.9
Parochial schools	36.6	47.2
Private	36.1	47.2
Regional (public schools only)		
New England	38.4	46.5
Middle Atlantic	37.9	50.9
Southern	35.5	53.5
Central	36.8	50.2
Western	37.2	53.2

Information received as to enrollment in various courses, College Preparatory, Commercial, Vocational, etc. appears to yield nothing significant.

SUMMARY AND CONCLUSION

It is difficult to find consistent correlations between different types of communities or different parts of the country, on the one hand, and the school organization or the school instruction, on the other. We find, as we might expect, more rapid alterations and adjustments in the cities than in the rural regions, or in more prosperous than in the economically backward regions. But there are no indications of consistent *progressions.*

Slightly over one-third of all replies came from teachers in rural schools, and about one-fourth from teachers in town schools. The remaining 40% came from teachers in large or small cities. The percentage of rural replies was highest from the Southern and Central regions.

Parent-teacher associations exist in connection with 68.5% of all schools reported, being more frequent in the cities. Most teachers regard them as exercising little or no influence on biology teaching. They are regarded as helpful by 28.7%, as harmful by only 1.5% of the teachers.

Promotion of teachers is reported in the main to depend upon successful teaching, with previous experience and amount of training each regarded about half as frequently as the basis of promotion. Seniority in the school system serves almost as often as a basis for promation, especially in city schools. Politics, prejudice, and favoritism are held to play but a small role.

The average length of the school year reported is 36.9 weeks, and the average class period is 50.6 minutes. In nine special large cities the class period drops to an average of 43.9 minutes.

The 6 + 3 + 3 type of school organization is about three-fourths as frequent as the 8 + 4 type. It is less than half as common in the rural schools, but is more common (5 : 3) in the schools reported from small cities. It is less common in the Central and Western states than in the rest of the country.

A three-year science program for the junior high school is found in 43% of the schools reporting. The greatest gains appear to have been made in the largest cities.

We cannot generalize broadly about the "modernizing" of schools and school systems from our information. But there are indications that increased financial support by communities has been accompanied by the selection of better trained administrators, who have adopted newer models in organization, and by a demand for better trained or more experienced teachers.

The variation among school communities revealed by this study may be taken to indicate that with the maturing of our intellectual and cultural life there is a tendency to get better trained teachers and supervisors; to value expertness in educators, as against personal opinion or group prejudices; and to use voluntary lay organizations for aiding the school rather than for influencing them for partizan, personal, or sectarian ends.

We find in a study of the schools and of science teaching one characteristic of social development that seems to deserve more general recognition: and that is a sort of abbreviation or even elimination of certain stages. Thus, there are many communities that in the past twenty or twenty-five years transformed their 8 + 4 school systems into 6 + 3 + 3 systems; but there are others that never had 8 + 4 schools. The consolidation of school districts made desirable by considerations of economy or of better staff and equipment, and made possible by improvements in transportation, have enabled many communities to pass almost over-night from antiquated schools to modern ones. In such development the "lag" is made up not by moving very rapidly through all the intermediate stages that separate the backward community from the more advanced, but by skipping entirely some of the intermediate trials and errors. A family that could not afford an automobile as soon as could some of its neighbors passed from the horse-and-buggy to a streamlined model without ever knowing "model T"; and many cities have gone from oil lamps to electric lighting without ever using gas lamps.

Biological Briefs

DITMARS, RAYMOND L. *Snake Venom—Destroyer and Healer.* Bulletin of the New York Zoological Society 44: 38–45. March–April, 1941.

Within the past 35 years, the production of antivenomous horse serum for snake bite has become standardized for use throughout the world. At first it was dried and sealed in small tubes, for solution in sterile water before use. Now all types are sealed as fluids, and will "keep" at room temperature for several years. Of far more recent development and more widespread application are forms of the venom itself in the treatment of serious human ills. These uses are based on the properties of the two main types of snake venom. The poison of the vipers is largely haemorrhagic, while that of the cobras is neurotoxic. Unexpectedly enough, injections of highly dilute viperine poison greatly reduce the amount of subsequent haemorrhage in human patients. Application of dilute fer-de-lance venom when applied externally to bleeding areas of the gums or nasal passages is effective, also. Dilute cobra venom is now being used to relieve severe pain, acting similarly to opium and morphine.

KING, ELEANOR. *Plants of the Holy Scriptures.* Journal of the New York Botanical Garden 42: 50–65. March, 1941.

Vegetation is an integral part of Biblical literature. Varying translations frequently caused controversy as to the plants to which original reference had been made; Linnaeus, who was one of the first to propound the existence of endemic species, finally suggested making a survey of the plants actually growing in the Holy Land. There is no controversy over identification of the Biblical fig, olive, and vine, nor over the almond, palm, and pomegranate. The ancients repeatedly plundered the forests of cedars of Lebanon. The "apple," however, was perhaps the apricot, since the true apple probably was not then grown in Palestine. The Biblical hyssop may have been our sorghum. Vegetables included cucumbers, watermelons, onions, leeks, and garlic. Manna probably came from lichens, and possibly also from the alga *Nostoc.* The "lily of the field" was probably the poppy anemone, while the "lily of the valleys" was either the iris or anemone. "Roses" were oleanders, tulips, and narcissi. Plants erroneously believed to have been known in Palestine in Biblical times include the crown-of-thorns, the prickly-pear cactus, the resurrection plant, the passion-flower, rose, and Easter lily.

THIMANN, KENNETH V. *The Hormone Control of Plant Development.* The American Naturalist 75: 147–153. March–April, 1941.

Three principal types of hormones are so far known in plants: those controlling flowering, those substances in the vitamin B group necessary for root elongation, and the auxins controlling many phases of growth and development. We have indirect evidence as to the first type, from experiments on photoperiodism. When only a small part of a "long-day" plant (where flowers appear after exposure to a series of sixteen-hour days) is exposed to a long day, buds appear on most of the branches. The local application of auxin to almost any part of the shoot causes a rapid acceleration of growth; on a given amount of tissue, the results are greater in the dark than in the light. Variations in hormonal supply may be due to internal factors, as in dwarf corn which destroys auxin, or external, as in the reduction of the growth of tomato plants when there exists a zinc deficiency. Flowering is in some way opposed to the auxin supply. Response to hormones may also vary. Auxin hastens the growth of the root initial, and hence is used commonly to root cuttings, but later inhibits both root elongation and lateral bud development.

ALLEN, JOYCE. *Capsules or Girdles?* The Australian Museum Magazine 7: 290–296. June–August, 1941.

The article summarizes the breeding behavior of molluscs. All are egg-layers; while in the highly developed species the sexes may be separate, most are hermaphrodites, and in some, as the Australian oyster, an individual may periodically reverse sex. After depositing the eggs in a suitable environment, most molluscs abandon them, although the octopus and some other forms show parental care. The eggs are protected either by gelatinous capsules or strings, as in the thin-shelled vegetable feeders, or by a horny capsule or sandy girdle, as in the strong-shelled carnivorous forms. Shore species may lay their eggs during calm seasons, or may abbreviate the free-swimming stage in order to lessen the danger of scattering by storms. The number of eggs may vary from a hundred in the land snails to many thousands in the bivalves and cephalopods and millions in the sea-hares. Since most young must depend for transportation on ocean currents, we frequently find large colonies of a single species settled in a small area.

RUTH SHERMAN STEIN.

Books

JORDAN, EDWIN O., and BURROWS, WILLIAM. *Textbook of Bacteriology.* 13th edition, revised, W. B. Saunders Company. xii + 731 pp. 170 figures. 1941. $6.00.

Intensive research still continues in many branches of the science of bacteriology. New organisms and new diseases are being discovered. Additional facts about old diseases are coming to light. Wherefore, in the opinion of the authors, frequent revisions of a textbook on bacteriology are necessary.

Many of the chapters in the latest edition of this standard work have been entirely rewritten, although the general form and the arrangement of the book have been retained. Several chapters devoted to special fields, such as soil, industrial, and dairy bacteriology have been replaced by a lengthy new chapter on bacterial physiology. The subjects of immunity and the filterable viruses have each been expanded to two chapters. As in previous editions, special emphasis is placed on disease-producing microorganisms. Spirochetes, yeasts, molds, parasitic Protozoa, bacteriophage, and Rickettesiae each come in for a separate chapter; the particular bacterial diseases receive extended consideration.

Besides possessing superior qualities as a textbook, this volume contains up-to-date material which makes it very practical as a reference work on sanitation and hygiene.

E.C.C.

WHEAT, FRANK M., and FITZPATRICK, ELIZABETH. *General Biology.* American Book Company, New York. 566 pp. 1932. $1.29.

Mechanical Make-up: This text is a standard, well-known edition in the listings of biology texts of the eastern states. It is a light wheat colored, $5\frac{1}{2} \times 8$ inch attractively bound volume constructed to fit the New York State General Biology Syllabus. It centers around man. The typography is of a single line well spaced and adequate arrangement. The paper is durable. The greater emphasis for visual illustration is on line cuts and photographs. There are no color plates. Many of the pictures, charts have been used elsewhere in a text written by the authors and, therefore, reflect in many instances, a lack of typographical distinctness. Many cannot be deciphered and lack artistic feeling. Charts, such as in diet, are included in appendix. It might be part of particular chapters' material.

Literary Style: It is interestingly and well written. Scientists are introduced to advantage at appropriate points. Stories with biological point serve to illuminate the text.

The language is not too difficult. Biological terms are italicized and adequately explained as they occur.

Chapter sub-divisioned headings are in heavy type and most sub-divisions are less than a page in length. These small units make for ease in reading. Respite the abundance of factual material there is very little feeling of crowding.

A device which makes for interest is the use of the second person. The book is written almost entirely in the third person.

Subject Matter: The first forty pages are directed at the individuals' interest in his own race by a discussion of the development of man from the prehistoric races to present day man including sections that deal with changes in types of implements and the domestication of plants and animals.

There are eleven units and 46 chapters, the titles of some are as follows: Man is one of Millions of Species, Nothing is as Unchanging as Change, Self Preservation Depends upon Nutrition and Protection, Life is a Variety of Adjustments, Man Controls and Improves his Environment, and Man has Progressed Through the Centuries.

The chapter on Plant and Animal Classification is quite detailed. About fourteen pages are devoted to conservation of forest, minerals, and soil with a brief mention to the species that are disappearing or have already become extinct. Over twenty pages are used for discussion of disease prevention and several interesting and practical experiments in elementary bacteriology are suggested.

Learning Exercises and Teacher Helps: The pupil suggestions in the form of problems are very good. The particular advantages of these topics are found in the clarity of presentation, the minimum of teacher aid in the pursuit of the exercise, and the small amount of special equipment necessary for the satisfactory completion of the study. The grouping of the problems at the end of a chapter, however, seems to make them seem like an afterthought rather than an integral part of the study of the material at hand.

The absence of good review questions for each chapter makes the book much less valuable to the student. The review quiz is effective, but if it is to be used greater emphasis should be placed upon understandings. Teacher helps are numerous and quite adequate.

Psychological Treatment: The richest contribution of this text is its use of pictures illustrating significant learnings. It is well-suited to a class in the tenth or the eleventh year in the high school. One would like to see a few really good scientific drawings to which the boy or the girl might turn repeatedly, and each time see something new and vital. The approach to the material is versatile enough to make good provision for individual differences.

Any student of the type who tends to be practical and who enjoys constructing apparatus, the drawing on page 496 explains how the lung works, would be stimulated to make this model just to watch it work. Books giving directions for the making of equipment fill a need felt by many students, those who learn by actually "seeing and doing."

ALAN A. NATHANS (Chairman)
MARTIN WEISS, New York
MILLIARD BOSWORTH, Vermont
DOUGLAS SALISBURY, Illinois
ANNE L. BIGLER, California

COLE, ELBERT C. *Text-book of Comparative Histology.* The Blakiston Company, Philadelphia. vii + 396 pp. 297 figures. 1941. $4.00.

Invertebrates and vertebrates are both considered in this book. Preference is given to the better known and widely used types. The 22 chapters are grouped under four sections. A short introductory section deals with the problems of histology, the nature of cells, and the origin of tissues. The second section treats each of the special tissues; the third discusses organs as tissue complexes, each system receiving special consideration; the final section has to do with instruments and methods, including care and use of the microscope, methods of recording data, and histological technique. The style is clear and concise.

The illustrations, consisting of photomicrographs and fully labeled drawings, are of great value in visualizing the structures described. Sufficient gross anatomy and embryological material are given to provide the requisite background. Short reference lists are appended to the chapters. There is a complete index. The author expresses the hope that the text will not only contribute to a general education of the student, but also serve as a basis for graduate study in the biological sciences and medicine. In the reviewer's opinion, it would also make an interesting and useful addition to the working library of the teacher of biology or zoology.

E.C.C.

SMALLWOOD, WILLIAM M. *Natural History and the American Mind.* Columbia University Press, New York. XV + 445 pp., illus. 1941. $4.25.

This is the story of natural history in the United States, from the earliest beginnings to the end of the period of the naturalists, about 1850. Although documented with hundreds of literature citations, the book is informal in style and only slightly technical in terminology. Careful attention is given to the contributions of natural history societies, museums, botanic gardens, publications, academies, lyceums, artists and engravers, microscopists and educational institutions. Of particular interest to biology teachers is the account of the struggle of natural history for academic recognition. The book abounds in quotations. Here is one from Captain John Smith, who is selected as an example of the early story-telling naturalist: "*An Opassum hath an head like a Swine,* and a taile like a *Rat,* and is of the bigness of a Cat. Vnder her belly shee hath a bagge, wherein shee lodgeth, carrieth, and sucketh her young." One other must suffice here. It is from a textbook designed for students in Yale College. "The best position for microscopical observations, is when the observer is lying horizontally on his back." The book includes several representative illustrations, a 68-page bibliography and an index sufficiently extensive to insure convenient reference use.

JOHN BREUKELMAN,
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BRUNER and OTHERS. *What Our Schools Are Teaching.* Bureau of Publications, Teachers College, Columbia University, New York. xii + 225 pp. 1941. $3.00.

This book is an analysis of the content of selected courses of study with special reference to science, social studies, and industrial arts. It is designed to bring down to date such analyses as those reported in *The Changing Curriculum,* edited in 1937 by Henry Harap. With reference to the sciences it concludes: the problem of sequence of science materials is now being given more attention than was formerly the case and overlapping is correspondingly reduced; there is evidence of a general tendency for the content of more recent courses in senior high school science (namely, physics, chemistry, and biology) to be less rigorously confined within the limits of these special fields than formerly; the environmental approach is attempted extensively in the selection and organization of the learning materials of junior high school sci-

ence; there is some evidence to show that makers of courses of study are becoming more conscious of the needs and interests of students of science; consumer education receives little or no attention in the courses of study examined; the lack of uniformity in organization and content in individual courses seems to indicate that, in the main, principles of organization and criteria for the selection of the materials of instruction have not been formulated; but some of the courses of study are obviously employing new criteria of organization.

DENTON L. GEYER,
Chicago Teachers College.

WECKSTEIN, A. M., POSTER, ETHEL. *Directed Activities in Biology.* Oxford Book Company, New York. 340 pp. 1941. $.72.

The authors, new to the textbook field, offer a perishable, soft-covered, $8\frac{1}{2} \times 11$ inch laboratory manual and work book that, according to their purpose, "provides complete coverage of the elementary biology course, as taught in leading school systems throughout the United States." It is designed to be used in conjunction with one or more of twenty textbooks listed. There are twenty-one units subdivided into many problems covering essential topics. There are numerous pupil and testing exercises. Vocabulary listings appear at the end of each unit of study. Linecuts are used exclusively for visual illustrations. Many of the drawings are integral parts of the testing exercise. A complete series of unit tests and a final review test accompany the text.

ALAN A. NATHANS.

The Junior Tree Warden is the title of a 92-page booklet on the tree-planting activities in the schools of New South Wales, Australia, published by the Department of Education, under the editorship of Miss Thistle Y. Harris, Teachers College, University Grounds, Newtown, New South Wales, Australia. This new publication gives many fine and practical suggestions for free planting and care by schools and students. It is well illustrated and might well serve as a pattern for similar booklets in the United States, Canada and Mexico.

Forest Trees of Illinois, How To Know Them. This is a revision of an earlier booklet under the same title, by Dr. Geo. D. Fuller, University of Chicago, in cooperation with Reverend George M. Link, State Naturalist, and Anton J. Tomasek, State Forester.

In addition to helpful keys, there are sixty pages, each devoted to the description and distribution of a single species. Each description is accompanied by excellent line drawings of twigs, leaves, buds, and fruits.

This new publication is available free to Illinois teachers upon application to the Division of Forestry, Department of Conservation, Springfield, Illinois.

P. K. HOUDEK.

STAUFFER, ANDREW (Editor). *Introductory Biology.* Third edition. Chicago Planograph Corporation. vi + 498 pp. 182 figures. 1941. $1.50.

This book, written by members of the departments of biology of the municipal junior colleges in Chicago, is designed as a text for a year of college biology. In Chicago the course follows the lecture-discussion-demonstration plan and is required of all students in the junior colleges. Emphasis is placed on principles rather than on types. The material is grouped under ten units dealing with the fundamental structure of living things, securing and digesting food, the history of food in living bodies, the transportation of materials within living bodies, the behavior of living organisms, reproduction, heredity, organic evolution, ecological relationships, and community health.

A majority of the illustrations are line cuts, many of them original. The page size is $6 \times 8\frac{3}{4}$ inches and the type is five-sixths the size of ordinary typewriter type, making it very legible. The book is securely sewed to lie flat and is bound in stiff cardboard and leatherette. There is an index. The text has been carefully edited with a view to the interests and background of the readers for whom it is intended.

ARE YOU DOING YOUR SHARE?

The National Association of Biology Teachers

is a non-profit organization composed of men and women who believe in their work and who want to see the advancement of the biological sciences in the interest of all the people. Its official organ, THE AMERICAN BIOLOGY TEACHER, also is operated without profit. All of the labor in writing, editing, and making-up the Journal, aside from the services of the printer, is donated. Are you doing your share? We need your subscription and the subscription of many new members in order to carry on successfully the work of the Association and the Journal. Eighty per cent of your dollar goes to pay the cost of publication. Where else can you obtain so much for so little?